

SUMMARY OF COST STUDIES

Implications for GSA Projects

"GSA's P100 requires all new construction and major modernization projects to be certified through the LEED program, with an emphasis on obtaining Silver ratings. Individual client agencies may also work with GSA to pursue even higher levels of LEED certification. Using the results of the LEED Cost Study, the GSA intends to refine the amount of "sustainability" funding provided for future projects (prior to the Cost Study, GSA has allocated a 2.5% budget increase for green building construction costs). The new budget allocation will be enough to ensure that projects can achieve LEED Certified ratings; however, project teams will be encouraged to achieve the highest level of LEED rating that is practical within the overall budget. With the revised budget allotments (which will likely vary between 2.5% and 4.0%, depending on the project), the study indicates that many Silver rated buildings should be possible, as well as occasional Gold rated projects. The opportunity to achieve Silver ratings or higher is also supported by GSA's general project contingencies and by the accuracy allowances of the cost estimates themselves. As illustrated in **Figure ES-1**, the range of estimated construction cost impacts for the Certified and Silver rated scenarios falls below the 5% estimating accuracy that would normally be expected of early conceptual estimates. In addition, the construction cost impacts for all of the rated scenarios, including Gold, fall below the 10% design contingency that is carried in most GSA project budgets at the concept phase. These numbers imply that in some scenarios depending on the design solution, market conditions, and other contingency factors), a LEED rating could potentially be achieved within a standard GSA project budget (without a green building budget allowance). By including a dedicated green building allowance, the potential for GSA buildings to achieve higher LEED rating levels - with the attendant benefits - is substantially greater."

2.) Cost of Green Revisited, Davis Langston Study (2007):

As noted in the paper, there are typically wide variations in costs per square foot between buildings on a regular basis, even when sustainability is not taken into account. Further, this normal variability "contributed to the lack of statistically significant building differences between the LEED-seeking and non-LEED seeking buildings."

The study also provides cost data on a credit-by-credit basis. While general guidance is possible, much depends on the actual circumstances of a given project.

3.) Costs and Benefits of Commissioning LEED-NC Buildings (2007)

by Peter D'Antonio of PCD Engineering Services

Study covers 11 LEED NC v 2.1 certified buildings in Colorado.

Builders often claim that building green or to the LEED criteria is too expensive and that they can't afford to incorporate high-performance or green features into construction. What is often left out of the discussion is the basis for this claim. For example, costs more compared to what? Compared to a similar building down the street; compared to the last building that was built; compared to the original budget, which may or may not have been based on the current goals of the project or market conditions; or compared to a code or jurisdictionally compliant building?

The study used as baseline the same building if it were built were not constructed to LEED-NC. Some project teams incorporated certain requirements of LEED, such as

commissioning or energy modeling, as business as usual and do not consider them additional costs. Therefore, the relative cost premiums in this study are exaggerated for such project teams.

The cost premium for LEED-NC version 2.1 certification ranged from 1% to 6% of construction costs, (hard and soft costs included):

Certified (5 buildings) 2.5%	Silver (3 buildings) 4.5%	Gold (1 building) 1.5%
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- Soft costs, including LEED registration and certification, LEED documentation, energy modeling and commissioning, average roughly 0.8% of the construction costs.
- Documentation costs for LEED certification submittals were difficult to quantify as the basis for the fee reporting was inconsistent with a reported range from less than \$3,000 to a maximum of almost \$60,000.
- Energy modeling averaged roughly \$10,000 across nine projects reporting data, with eight projects reporting cost at or below \$10,000 and one project reporting cost of nearly \$35,000. Smaller projects exhibited higher costs per square foot than larger projects. All of the teams designed and built their projects to at least 20% better than the requirements of ASHRAE 90.1- 2001. The net present value of the energy savings associated with the project energy efficiency measures offset all of the LEED soft and hard costs in seven of the nine projects reporting energy savings data.
- Commissioning is a significant soft cost accounts for roughly 60% of total soft costs.
- Life-cycle cost analysis (LCCA) is a valuable tool in creating a high-performance building. LCCA is employed on all projects for Poudre School District, Colorado College and the City of Boulder, and their designs are some of the most aggressive in terms of energy-efficiency.

4.) The Cost and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force (2003) Greg Kats of Capital E:

Average cost premium of 1.84% for 33 California buildings achieving various levels of LEED certification. (Hard and soft costs included; soft costs dominant.)

Certified 0.66%	Silver 2.11%	Gold 1.82%	Platinum 6.50%
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Cost data was gathered on 33 individual LEED registered projects (25 office buildings and 8 school buildings) with actual or projected dates of completion between 1995 and 2004. These 33 projects were chosen because relatively solid cost data for both actual green design and conventional design was available for the same building.

Pg. 14 "LEED Silver certification should not add cost to a project provided the following:

- LEED Silver is made a requirement in the Request for Qualification for the Design Team and embedded within the construction documents, building construction, and commissioning.
- The selected Design Team has sustainable design embedded within the firm's design culture.
- Contractors, Property Managers, Real Estate Analysts, Budget Analysts, Crew Chiefs and Custodians are included on the Design Team.
- Selected sustainable design strategies are "whole system" in nature and integrated design"

Minimal increases in upfront costs of about 2% to support green design would, on average, result in life cycle cost savings of 20% of total construction costs. For example, an initial

upfront investment of up to \$100,000 to incorporate green building features into a \$5 million project would result in a savings of \$1 million in today's dollars over the life of the building.

Executive Order D-16-00 establishes the Governor's sustainable building goal: "to site, design, deconstruct, construct, renovate, operate, and maintain state buildings that are models of energy, water, and materials efficiency; while providing healthy, productive and comfortable indoor environments and long-term benefits to Californians...The objectives are to implement the sustainable building goal in a cost effective manner...; use extended life cycle costing; and adopt an integrated systems approach.²"

The majority of this cost is due to the increased architectural and engineering (A&E) design time necessary to integrate sustainable building practices into projects. Generally, the earlier green building gets incorporated into the design process, the lower the cost.

Figure ES-1. Financial Benefits of Green Buildings Summary of Findings (per ft²)

Category	20-year NPV
Energy Value	\$5.79
Emissions Value	\$1.18
Water Value	\$0.51
Waste Value	
(construction only), 1 yr.	\$0.03
Commissioning O&M Value	\$8.47
Productivity and Health Value	
(Certified and Silver)	\$36.89
Productivity and Health Value	
(Gold and Platinum)	\$55.33
Less Green Cost Premium	-\$4.00
Total 20-year NPV (Certified and Silver)	\$48.87
Total 20-year NPV (Gold and Platinum)	\$67.31

Source: Capital E Analysis

5.) Analyzing the Cost of Obtaining LEED Certification (2003)

by The American Chemistry Council

While empirical and projected data vary widely, LEED certification adds from 4% to 11% to a project's construction costs, more than half of which go to "greening". The rest are soft costs including design, documenting compliance, and commissioning.

SOFT COSTS:

- Maryland's Green Building council estimates soft costs for attempting LEED Silver contribute an additional 3-5% to construction costs.
- R.S. Means estimates that additional design costs for greening a building represent 5% of project design costs or 0.4-0.6% of total construction costs.
- R.S. Means estimates commissioning costs to be between 0.5% to 0.75% of construction costs.
- Weidt Group found commissioning ranged from 0.75% to 1.5% of total construction costs.
- Documentation costs and fees required to register and certify a project.

Fees Vary with the size of project from \$2,250 to \$11,250.

USGBC reported documentation costs at \$30,000 to \$60,000 for teams working on their first LEED project, and as low as \$10,000 for experienced teams.

- Means estimates a cost of \$0.05 to \$0.45 per square foot for energy modeling, depending on project size.

Natural logic estimates that energy modeling adds \$15,000 to \$30,000 per project.

Soft Cost Estimate Summary

(Incremental cost as a percentage of construction costs)

	Best Estimate	Range
Design Costs	0.5%	0.4% - 0.6%
Commissioning	1%	0.5% - 1.5%
Documentation & Fees	0.7%	0.5% - 0.9%
Energy Modeling	0.1%	0.1%
Total	2.3%	1.5% - 3.1%

Greening Costs

While this is potentially the larger area of incremental costs (sources we consulted variously estimated these additional costs at up to 30 percent of construction costs), many of the available examples do not isolate these costs and for those that do the data vary across a large range. We believe a reasonable estimate is that greening adds between three and eight percent to the cost of a “typically” constructed building.

As is common, the definition of baseline varies from project to project, which limits adapting cost data to other projects. The study noted that it lacked adequate data to develop a statistically based value for greening costs.

GW NOTE: **Should we use this study? It cited almost no data for hard costs.**

6.) Does Green Pay Off? (2007)

According to surveys of those meeting LEED certification, the average costs are reported to be about: **(not clear if both hard and soft costs were include)**

Certified 3% Silver 5.5%

And quoted data from the USGBC which varies by region:

USGBC Data, Extra Cost Varies by Region

Market	Platinum	Gold	Silver
UCSB Ave.	7.8 %	2.7 %	1.0 %
San Fran.	7.8 %	2.7 %	1.0 %
Merced	10.3 %	5.3 %	3.7 %
Denver	7.6 %	2.8 %	1.2 %
Boston	8.8 %	4.2 %	2.6 %
Houston	9.1 %	6.3 %	1.7 %
Average	8.6%	4.0%	1.9%

7.) Greening America's Schools Costs and Benefits (2006) Kats, et al.

Average cost increase of less than 2%, or about \$3/SF, for a green school with an average efficiency improvement of 33%.

ENERGY EFFICIENCY STRATEGIES FIRST COST STUDY SUMMARIES:

8.) NAVFAC Energy Policy Act of 2005 Studies of various Navy Facilities (2006)(not publicly available)

These designs used the lowest-cost, life-cycle cost effective, Energy Efficiency Measure (EEM) combination meeting 30% below ASHRAE Standard 90.1-2004 for 3 Naval Facilities, including both hard and soft costs for energy strategies only:

Enlisted Quarters +2.22% hard and soft costs

(= 10% of added hard costs) plus \$20,000 for modeling

Academic and Headquarters Building +1.07% hard and soft costs

(= 10% of added hard costs) plus \$20,000 for modeling

Mission Support Facility +3.19% hard and soft costs

(= 10% of added hard costs) plus \$20,000 for modeling

Advanced Energy Design Guide. Estimated Percent Cost Increase for Energy-Efficient for Warehouse (50,000 sf Prototype). Hard costs for energy strategies.

Climate Zone 4, the Unit cost over median baseline was \$2.00/ft²

Percentage of cost increase over median baseline 3.5%

Simple Payback in years for climate 4B was 7.7 years